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(54) Name of Invention: Oil Impregnated Electrical Machinery

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Specifications

1. Name of Invention
Oil Impregnated Electrical Machinery
2. Scope of the Patent Claims
(1) Oil impregnated electrical machinery characterized by the use of an electrical insulation oil in which alkyl methacrylate type polymers are added to a vegetable oil.
(2) Oil impregnated electrical machinery as described in scope of page 1 of the claims of the patent as a result of the addition of 0.01~5wt% of alkyl methacrylate type polymers.
3. Explanation of the Details of the Invention
Field of Industrial Use
This invention attempts to offer high reliability oil impregnated electrical machinery by means of improving upon the low temperature conditions of vegetable oils used with oil impregnated electrical machinery such as condensers, transformers, et cetera.
The Hithertofore Technology and the Problems Thereof
Hithertofore, hydrocarbon type of insulation oils such as mineral oil, alkyl benzene, alkyl diarylethane, alkyl naphthalene, et cetera, were used as electrical insulation oils but these, although they are relative stable in terms of heat, because they have low dielectric constants,

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there was the idea of using vegetable oils, which have relatively high dielectric constants. The dielectric constants of vegetable oils is 3.1~4.5 times higher than those of hydrocarbon type of insulation oils, and in addition, the swelling of the polypropylene films (hereinafter referred to as PP film), which are widely used as oil saturated material, is slight, and there is the characteristic of the improved saturation between the layers of the dielectric constants of oil saturated condensers, et cetera.

Although there is a variety of vegetable oils, but amongst them, the ones used as insulation oils are the anhydrous oils or the hemi-hydrous oils; furthermore they are oils with good electrical characteristics, low viscosity, and low pour points. Thus the characteristics of a number of vegetable oils which could be used as insulation oil are indicated in Chart *1*. Of these, castor oil has the lowest pour point, but it has high viscosity; the others have low viscosity, but their pour points are at *-5 ~ -20 °C* or higher, and have the weakness of problems under low temperatures for oil impregnated electrical machinery.

Pat[ent]. Dis [closure]. Sho[wa]. *61* [1986] - *260503(2)*

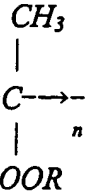
Chart 1

	Relative Dielectric Constant *(20 °C)*	Iodine Value *(g/100g)*	Viscosity Rate *(cst)* *(25 °C)*	Pour Point *(°C)*
Rapeseed Oil	*3.1*	*116*	*50*	*-20*
Cotton Seed Oil	*3.1*	*110*	*54*	*- 5*
Soy Bean Oil	*3.2*	*130*	*60*	*- 7.5*
Castor Oil	*4.5*	*86*	*685*	*-30*

Procedures for Resolving the Problematic Points

For the purpose of improving the low temperature characteristics of the oil impregnated electrical machinery which use vegetable oils, there is the need to improve the pour point of the vegetable oils. With this invention, it was confirmed by means of experiments that it is possible to lower the pour point by the combination of alkyl methacrylate type polymers to a vegetable oil.

That is to say, alkyl methacrylate type of polymers are commonly indicated according as [Please refer to the original for actual illustration.]



R is the polymerization

n is the degree of the alkyl group

Poly alkyl methacrylate (hereinafter referred to as *PMA*) are a type added to petroleum type of lubricants to improve on the pour point; with this invention, it was discovered

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Chart

Rapeseed Oil	*PMA*	Quantity of *PMA* Added *(wt%)*					
		0	*0.01*	*0.1*	*1.5*	*3*	*5*
Rapeseed Oil	*A*	*-20(°C)*	*-27.5*	*-32.5*	*-32.5*	*-30*	*-25*
Rapeseed Oil	*B*	*-20*	*-27.5*	*-32.5*	*-30*	*-30*	*-22.5*
Cottonseed Oil	*A*	*-5*	*-10*	*-20*	*-20*	*-16*	*-10*
Soy Bean Oil	*A*	*-7.5*	*-12.5*	*-20*	*-22.5*	*-17.5*	*-10*

that it is effective when combined with vegetable oils which are used as electrical machinery insulation, In addition, it was confirmed that the addition at a ratio of *0.01~5wt%* is appropriate.

Embodiment

The following will explain using experiment data.

The pour points of the oil mixtures resulting from the addition of *PMA* with an average molecular weight of *70000 (A)* and of *PMA* of an average molecular weight of *100000 (B)* to rapeseed oil, which is a vegetable oil, were measured. In addition, the pour points for the oil mixtures resulting from the addition of *PMA* with an average molecular weight of *70000 (B)* to cotton seed oil and soy bean oil were respectively measured. The pour points were obtained by means of the test method of *JIS C 2101.*

The results thereof are indicated in Chart *2*

When PMA is combined with a vegetable oil, the pour point is lowered by a maximum of *15 °C* as compared to the pour point of oil with no addition. The quantity added which is appropriate is *0.01 ~ 5%wt%*; it was learned that if the quantity added is increased, the effect is diminished.

Effects of the Invention

As indicated in the above, when *PMA* is added to a vegetable oil, the pour point of the vegetable oil is lowered, thus assuring pour characteristics at low temperatures so that improvement in the reliability of oil impregnated electrical machinery using vegetable oils is obtained.

PMA is a viscous polymer, and it is commonly used for dilution of dilute mineral oils, alkyl benzene and such at approximately *50%* dilution in order to improve upon handling characteristics; the addition of *PMA* may be considered to be of the same sort.

Although the embodiment shows examples with rapeseed oil, soy bean oil, and cotton seed oil, similar results are obtained with other vegetable oils. In addition, the food grade vegetable oils used were those standardized under the Japanese Agricultural Standards ([Japanese] Ministry of Agriculture and Forestry Ordinance Number *523*) so that it is needless to say that in terms of hygiene, they are extremely safe.

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[Translator's Note: The phonetic reading of the name appearing here (Shigeyoshi Nishikawa) is an educated guess. It is not possible to give a definitive phonetic reading of most names of individuals.]